UNITED STATES ATOMIC ENERGY COMMISSION

TID-3011(1st rev.)

# NUCLEAR SCIENCE IN ENGINEERING EDUCATION

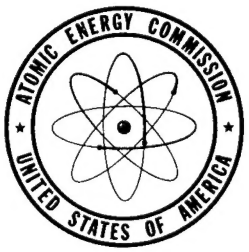
## A Selected List of References for Instructors

First Revision

Compiled by
Simone B. Schwind



September 1952



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# A SELECTED LIST OF REFERENCES FOR INSTRUCTORS
# FIRST REVISION

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## INTRODUCTION

This revised version of TID-3011 contains pertinent entries from the first version as well as new references selected from the considerable bulk of material of interest to engineers which has appeared recently. Some entries from the original version were not included in the present one, either because more up-to-date material covering the topic was located, or because the documents were no longer available.

The bibliography covers reports of the U. S. Atomic Energy Commission and its contractors, the journal literature, textbooks, and reference books. Additional references may be found by consulting the current issues of Nuclear Science Abstracts. This semimonthly journal, prepared by the Atomic Energy Commission, covers reports and journal literature. In addition, each issue carries a summary of new nuclear data, which is prepared in collaboration with the National Bureau of Standards, and keeps up-to-date the data contained in NBS Circular 499 and its supplements. Quarterly cumulations appear in the Index Issues of NSA.

The references in the bibliography are listed by title under the headings listed below. When a reference covers one or more subjects it is listed only once, either under General or under the major subject. An author index and a report number index are found at the end of the listings.



Published reports should be sought in the journals or books cited in the references. The code numbers of such reports are given for information only; they do not indicate availability from the AEC.

The non-published reports are available at the AEC depository libraries. A list of these libraries is found following the indexes.

When a price is given at the end of a reference, that report may be purchased from the

Office of Technical Services
Department of Commerce
Washington 25, D. C.

# REFERENCES

GENERAL PAPERS

1

APPLIED ATOMIC ENERGY. K. Fearnside, E. W. Jones, and E. N. Shaw. Loudon, Temple Press, Ltd., 1951. 156p.

Descriptions and illustrations of the use of radioisotopes in the field of research, biology, medicine, agriculture and industry. Brief chapters on nuclear physics and nuclear reactors, preparation and distribution of radioisotopes, legal aspects of atomic energy, and difficulties of international control are included.

2

THE BIRMINGHAM PROTON SYNCHROTON. L. V. Hibbard. Nucleonics 7, 30-43(1950) Oct.

A detailed description.

3

BRITISH VIEW OF NUCLEAR POWER. J. D. Cockcroft. Nucleonics 10, 21-3(1952) Jan.

Problems of reactor technology and what the British are doing about them.

4

CONFERENCE ON FISSION PRODUCT UTILIZATION HELD ON FEBRUARY 18-19 1952. Brookhaven National Laboratory. [n.d.] 49p. (BNL-171) UNCLASSIFIED

Report of the first conference held to investigate the possibilities of finding commercial use for fission products.

5

DESIGN AND CONSTRUCTION OF RADIOCHEMICAL LABORATORIES; A SELECTED LIST OF UNCLASSIFIED REFERENCES. Technical Information Service, AEC. Oct. 1, 1951. 5p. (TID-3013) $0.10

A selective bibliography containing 83 references to reports and journal articles, with brief annotations.

6

DEVELOPMENT OF ATOMIC ENERGY-HOW CAN PRIVATE INDUSTRY BEST PARTICIPATE? P. Sporn. Nucleonics 8, 9-12(1951) Feb.

Reasons for the lack of participation by industry in the development of atomic energy are discussed.

7

ENGINEERING IN THE ATOMIC AGE. W. E. Kelley. Nucleonics 7, 5-8(1950) July

Stresses the need for engineers with thorough grounding in their own field rather than for nuclear engineering specialists, and for closer collaboration between engineers and scientists.

8

ESTABLISHING AN INDUSTRIAL RADIOISOTOPE PROGRAM. J. R. Carlin and W. C. Nusbaum. Chem. Inds. 67, 886-9(1950).

Attention is called to the various factors and requisites which should be considered in the application of isotopes to industrial fields.

9

A FACTUAL LOOK AT OUR ATOMIC ENERGY PROGRAM. Gordon Dean. Nucleonics 10, 19-21(1952) Jan.

The factors which help determine the over-all size of the program, future expansion, and problems of materials, power and men are discussed.

10

GROWTH IN PEACETIME USES OF ATOMIC ENERGY. P. C. Aebersold. In lectures presented at the Inservice Training Course in Radiological Health, Feb. 5-8(1951). Ann Arbor, University of Michigan School of Public Health, 1951. p.17-28.

The use of atomic energy for production of heat and electrical power, the use of atomic radiation and atomic heat to induce chemical and physical changes, applications of results of researches in atomic science to other fields, and the application of radioactive isotopes for tracing atoms and other unique purposes are discussed. Present uses of radioisotopes in medicine, agriculture, the basic sciences, and industry are summarized.

11

HOW TO SIZE UP THE ATOMIC BOMB. Part 2. P. W. Swain. Power 94, 74-9(1950) Nov.

A discussion of atomic bombs in terms of engineering, mathematics, and physics.

12

INDUSTRIAL AND SAFETY PROBLEMS OF NUCLEAR TECHNOLOGY. M. H. Shamos and S. G. Roth, eds., New York, Harper & Brothers, 1950. 368p.

A collection of papers given at a conference sponsored jointly by the Atomic Energy Commission and New York University's Division of General Education. Technological problems and dangers peculiar to the development of atomic power, exclusive of nuclear reactors, are discussed.

13

INDUSTRIAL USES OF RADIOACTIVE FISSION PRODUCTS; W. B. Gibson and R. A. Krause. Stanford Research Institute. [n.d.] 106p. (AECU-1673) (For sale from Stanford Research Institute, Project 361, $1.50)

Technical, engineering, and economic considerations are covered, and a variety of possible industrial uses for fission products are discussed.

14

INDUSTRY'S ROLE IN ATOMIC ENERGY. Nucleonics 10, 93-108(1952) June

Details of the impact of the atomic energy program on industry.

15

AN INVITATION TO INDUSTRY. T. K. Glennan. Nucleonics 10, 16-19(1952) Jan.

A discussion of some aspects of the present and future role of industry and business in the atomic energy program.

16

ISOTOPES AND THEIR APPLICATION IN THE FIELD OF INDUSTRIAL MATERIALS; EDGAR MARBURG LECTURE. P. C. Aebersold. Am. Soc. Testing Materials 48, 1-28 (1948). (M-4359)

Discussion of properties and production of isotopes; radioisotope measurement; facilities and safety precautions; basis for isotope application; illustrations of applications of radioisotopes and stable isotopes.

17
LABORATORY DESIGN FOR HANDLING RADIOACTIVE MATERIALS. Washington, Building Research Advisory Board, National Research Council, 1951. 140p.

Proceedings of a conference held in Washington, D. C., in November 1951, sponsored by the American Institute of Architects and the Atomic Energy Commission. Laboratory layout and construction, shielding, surfaces and finishes, air supply and exhaust, and waste disposal are discussed. Illustrated. Also contains a bibliography and glossary of nuclear terms.

18
NEW HOT LABORATORIES AT ARGONNE. H. L. Hull, R. C. Goertz, and K. R. Ferguson. Argonne National Laboratory. Oct., 1949. Declassified Oct. 23, 1950. 13p. (AECD-2990; ANL-4385)

Samples up to 100 curies, 1 Mev gamma can be handled with safety, and a wide variety of physical-property measurements can be made by remote control. The master-slave manipulator is briefly described and illustrated, and the new transparent shielding windows are discussed.

19
NUCLEAR ENGINEERING COURSE AT NEW YORK UNIVERSITY. F. D. Maslan. Nucleonics 7, 84-7(1950) Oct.

A commentary on the development of the graduate course, with course outline.

20
NUCLEAR SCIENCE AND ENGINEERING SCHOOL CURRICULA. B. W. Bartlett. Nucleonics 8, 68-71(1951) May.

An educator's judgment on the future demands nuclear technology will make on scientific personnel and how the engineering school can best prepare its students to meet them.

21
OPPORTUNITIES IN ATOMIC ENERGY. K. D. Hartzell. New York, Grosset and Dunlap, Vocational Guidance Manuals, 1951. 144p.

The American program for development of atomic energy is reviewed; the organization and functions of the AEC and its contractors are outlined; personnel requirements, opportunities, and average salaries are listed.

22
PHYSICS IN THE ATOMIC ENERGY PROGRAM; T. H. Johnson. Division of Research, AEC. Dec. 27, 1951. 13p. (WASH-72)

The role of physicists in the Atomic Energy programs, the setup of the Commission's research program including the National Laboratories and research project in university and industrial laboratories, and the criteria for effective administration of research contracts are discussed.

23
PLANNING A SMALL RADIOISOTOPE PROGRAM. G. W. Reid and O. M. Bizzell. Ind. Med. Surg. 19, 549-53(1950).

A brief but authoritative discussion of the problems involved in setting up an isotope program. Several sources of reliable information on the safe handling and use of radiomaterial, relative costs of the major items required in a radioisotope laboratory, an outline of the waste disposal problem, and examples of some of the cooperative programs in this field are given. The essentiality of adequate preliminary training is stressed.

24
PROBLEMS IN PLANNING FACILITIES FOR RADIOCHEMICAL PROCESS DEVELOPMENT. A. C. Jealous. Oak Ridge National Laboratory. February 1949. Declassified Feb. 25, 1949. 17p. (AECD-2512) $0.10

Discusses problems in the design of installations; describes structures in use at ORNL; and some of the latest designs suggested for new process development facilities.

25
PRODUCTION OF ATOMIC ENERGY BY NUCLEAR REACTIONS. P. Wessel. Atomics 6, 23-9(1950) Nov.-Dec.

A general review of the development of nuclear energy.

26
PROSPECTS IN INDUSTRIAL APPLICATION OF ATOMIC ENERGY. P. Sporn. Bull. Atomic Scientists 6, 303-6(1950) Oct.

The following topics are discussed: problems of reactor development, with $U^{235}$ and plutonium as fuels, and analogies to a coal-fired boiler; the reactor development program with reference to four types of reactors for (1) materials testing, (2) use in propelling naval vessels, (3) breeding, and (4) electric power; industrial effects of atomic power, relating the discussion to present costs and uses of electric power; and atomic power and the coal industry.

27
THE RADIOACTIVE ISOTOPE LABORATORY UNIT AT TECHNICAL DEVELOPMENT SERVICES. J. A. Jensen. Comm. Disease Center Bull., 26-8(1950) Nov.

Laboratory equipment and facilities for the medium-sized organization of Technical Development Services, Savannah, Ga., are described.

28
RADIOISOTOPE APPLICATIONS OF INDUSTRIAL SIGNIFICANCE; AS LISTED IN "ISOTOPES A FIVE-YEAR SUMMARY OF U. S. DISTRIBUTION." Technical Information Service, AEC. April 1952. 89p. (TID-5078) $0.30

Includes radioactive isotope allocations made from Aug. 2, 1946 through June 30, 1951. Institution, investigator, isotope, project, and status or journal reference are given for each. A subject index is included.

29
RADIOISOTOPES; INDUSTRIAL APPLICATION. G. H. Guest. Toronto, Sir Isaac Pitman and Sons, Ltd., 1950. 185p.

Basic ideas involved in the use of radioisotopes and their application in industry.

30
THE ROLE OF ENGINEERING IN NUCLEAR ENERGY DEVELOPMENT; THIRD ANNUAL OAK RIDGE SUMMER SYMPOSIUM; AUGUST 27 TO SEPTEMBER 7, 1951; N. F. Lansing, comp., Oak Ridge National Laboratory and Oak Ridge Institute of Nuclear Studies. Dec. 1951. 516p. (TID-5031) $1.40

A complete record of the procceedings is presented. Part I contains several discussions of general interest; Part II is concerned with the scientific background of nuclear energy; Part III contains several papers on various engineering topics related to reactor design; Part IV is a record of the panel on "Nuclear Engineering Education".

31
SECRECY IN NUCLEAR ENGINEERING. J. G. Beckerley. Nucleonics 10, 36-8(1952) Jan.

Discusses whether we can effectively compete in the world atomic race unless we let down the barriers of secrecy.

32
SYMPOSIUM ON NUCLEAR ENGINEERING. J. Eng. Education 41, No. 7, 362-82(1951)

Lectures given at the symposium held at Fontana Village, N. C., Aug. 28-30, 1950. Included are: "Nuclear Engineering" by D. W. Cardwell; "Program of Oak Ridge Institute of Nuclear Studies" by W. G. Pollard; "Engineers

for Atomic Energy" by P. N. Powers; "Subject Matter in Nuclear Engineering" by M. D. Peterson; "Nuclear Engineering at North Carolina State College" by C. K. Beck.

33

UNDERGRADUATE NUCLEAR ENGINEERING CURRICULUM AT NORTH CAROLINA STATE COLLEGE. C. K. Beck. Nucleonics 8, 54-9(1951) Jan.

The curriculum provides a sequence of basic courses in the field of nuclear engineering integrated with and interspersed among the usual courses in fundamental science and engineering.

34

UTAH'S NEW URANIUM MILL. J. A. Butler. Eng. Mining J. 152, 56-62(1951) March

A description of procedures used at the Monticello mill for the treatment of carnotite ores.

35

THE VACUUM SYSTEM OF THE BIRMINGHAM PROTON SYNCHROTRON. L. Riddiford. J. Sci. Instruments, Suppl. 1, 47-58(1951)

The theoretical requirements of the vacuum system of the Birmingham $1.3 \times 10^9$ ev proton synchrotron are considered, and the design and development work performed to satisfy these requirements is described in some detail.

36

WANTED: REACTOR ENGINEERS. Nucleonics 10, 10-13 (1952) Feb.

Brief description of facilities and curriculum of the Oak Ridge School of Reactor Technology and report of a survey showing how industry is using graduates from the school.

37

WHY SEPARATE STABLE ISOTOPES? C. P. Keim. Oak Ridge National Laboratory, Sep. 25, 1950. 18p. (Y-662)

A non-technical presentation of the nature of stable isotopes; background of the AEC stable isotope program; important applications of stable isotopes.

## ELEMENTARY NUCLEAR SCIENCE

38

CHART OF THE NUCLIDES. General Electric Company, 1950.

Physical constants data for all experimentally identified nuclides from information availiable to December 1949.

39

COURSE IN NUCLEAR PHYSICS FOR ENGINEERS. C. Helmholz. Univ. of California. Declassified Jan. 28, 1947. 150p. (MDDC-1014)

A series of lectures on the various cyclotrons and other ion accelerators in use at the Radiation Laboratory.

40

NEUTRON CROSS SECTIONS. Neutron Cross Sections Advisory Group, AEC. May 15, 1952. 203p. (AECU-2040) $1.00

A compliation in tabular and graphic form of nutron cross section data based on all published values together with unpublished values available to the Advisory Group. Included are several pages of the thermal cross section tables and 184 graphs containing curves showing the variation of cross sections with energy. Each graph is printed full size, regardless of the amount of data available, so that the book may be used as a reference volume and work book.

41

NEUTRON PHYSICS; A REVISION OF I. HALPERN'S NOTES ON E. FERM'S LECTURES IN 1945. J. G. Beckerley. New York Operations Office, AEC. [nd] 96p. (AECD-2664) $0.35

Covers neutron sources; collisions of neutrons with nuclei; stable isotope chart and reactions involving neutrons; models of nuclei reactions; scattering of neutrons; slowing down of neutrons; distribution of slow neutrons in a medium; nuclear fission.

42

NUCLEAR DATA. K. Way, L. Fano, M. R. Scott, and K. Thew, comps. National Bureau of Standards. Washington, U. S. Government Printing Office, Sept. 1, 1950. 309p. (NBS Circular 499)

A collection of experimental values of half-lives, radiation energies, relative isotopic abundances, nuclear moments, and cross sections, with each value documented.

43

NUCLEAR DATA. SUPPLEMENT 1. K. Way, M. Wood, and K. Thew, comps. National Bureau of Standards. Washington, U. S. Government Printing Office, April 25, 1951. 56p. (Supplement 1 to NBS Circular 499)

Additional information on data listed in Circular 499 and tabulation of new types of data including: nuclear scattering lengths, packing fractions and mass differences; notes on isotope shifts; ranges of $\alpha$ particles in photographic emulsions; information on nuclear reactions in the light elements, $Z \leq 20$.

44

NUCLEAR DATA, SUPPLEMENT 2. K. Way, G. Fuller, M. Wood, K. Thew, and A. Jurgens, comps. National Bureau of Standards. Washington, U. S. Government Printing Office, Nov. 26, 1951. 63p. (Supplement 2 to NBS Circular 499)

The only major class of new information included in this supplement is a year's list of fission and spallation papers.

45

NUCLEAR DATA, SUPPLEMENT 3. K. Way, G. Fuller, M. Wood, K. Thew, and A. Jurgens, comps. National Bureau of Standards. Washington U. S. Government Printing Office, June 9, 1952. 66p. (Supplement 3 to NBS Circular 499)

This supplement is the last which will be issued in conjunction with NBS Circular 499. Current nuclear data, collected by the NBS Nuclear Data Group, are published regularly in Nuclear Science Abstracts, beginning with Vol. 6, No. 1, dated January 15, 1952. Quarterly cumulations appear in the Index Issues.

46

NUCLEAR DATA FOR LOW-POWER REACTORS. Nucleonics 8, 78(1951) Jan. (TID-235)

Data released by Canadian, British and United States authorities on nuclear properties of importance in the design and operation of low-power research reactors.

47

TABLE OF ISOTOPES. G. T. Seaborg and I. Perlman. Revs. Modern Phys. 20, 585-667(1948). (AECU-14; UCRL-179)

A complete list of all artificial and naturally radioactive and stable isotopes known to date together with a number of important features covering information available by Oct. 1948; extensive references.

48

TRILINEAR CHART OF NUCLEAR SPECIES. W. H. Sullivan. New York, John Wiley and Sons, 1949.

The systematics of and physical constants data for all experimentally identified nuclides from information available to June 1949.

## REACTOR THEORY

49

CALCULATION OF SHIELDING PROPERTIES OF WATER FOR HIGH ENERGY NEUTRONS. C. P. Hammer. Los

Alamos Scientific Laboratory. [nd] 4p. (AECU-630; LADC-717) $0.05

Formulation of the problem of determining the shielding effectiveness of a 100 cm thick wall of water to 14 Mev neutrons normally incident upon it.

50

THE DESIGN OF AN ATOMIC REACTOR. Power Generation 52, 73, 136(1948) Dec.

Description of a reactor design with arbitrary constants: an experimental nuclear reactor which will be a pilot plant for a reactor for a power plant producing 10,000 kw of electricity.

51

THE ELEMENTS OF NUCLEAR THEORY. S. Glasstone and M. C. Edlund. New York, D. Van Nostrand Co., Inc. (Scheduled for publication in Nov. 1952)

Treatment of nuclear structure and nuclear reactions, dealing with neutron reactions, the properties of neutrons and the relationships that have been worked out to determine the various nuclear reaction rates and products; theory of nuclear reactors of various types, their control and behavior.

52

EXPERIMENTAL STUDY OF THE CHÂTILLON PILE KINETICS. A. Ertaud, R. Beaugé, H. Fauquez, and L. Vautrey. J. phys. radium 12, 17A-25A(1951) Oct.

Experimental reactivity curves of the Châtillon $D_2O$-moderated natural-U reactor are shown. A linear expression for the change in reactivity as a function of three parameters (heavy-water level, position of control rods, and temperature) is given.

53

GAMMA RAY SHIELDING FOR ENGINEERING REFERENCE. J. M. Ruddy. Brookhaven National Laboratory. Feb. 15, 1951. 44p. (AECU-1211)

Data are provided for computing gamma-ray attenuation through medium and heavy shields of lead, iron, or concrete.

54

AN INTRODUCTION TO HIGH VACUA IN NUCLEAR PHYSICS. A. S. Baxter. Vacuum 1, 185-190(1951)

An outline of the needs for high vacuums in the study of nuclear physics and the consequent parallel developments within these subjects.

55

MATHEMATICAL METHODS IN PILE CALCULATIONS. H. Hurwitz, Jr. Knolls Atomic Power Laboratory. Nov. 10, 1950. Declassified Dec. 4, 1950. 8p. (AECD-3019)

Brief explanations of some of the theoretical calculation methods used for computing properties of assemblies of fissionable material.

56

METHOD FOR MEASURING NEUTRON-ABSORPTION CROSS SECTIONS BY THE EFFECT OF THE REACTIVITY OF A CHAIN-REACTING PILE. H. L. Anderson, E. Fermi, A Wattenberg, G. L. Weil, and W. H. Zinn. Phys. Rev. 72, 16-23(1947). (MDDC-669)

Method using calibration of control rods displacement.

57

NEUTRON PENETRATION AND SLOWING DOWN AT INTERMEDIATE DISTANCES THROUGH MEDIUM AND HEAVY NUCLEI. H. A. Bethe, L. Tonks, H. Hurwitz, Jr. Phys. Rev. 80, 11-19(1950). (AECD-2790)

Theoretical results and numerical calculations of neutron slowing down and penetration to fairly large distances from the source, assuming constant mean free path and no absorption.

## REACTOR TECHNOLOGY

58

ATOMIC CONTROL OF POWER REACTORS. M. A. Schultz. Westinghouse Atomic Power Division. Declassified May 24, 1951. 42p. (AECD-3163) $0.20

The use of automatic controls for power producing reactors is discussed with reference to start-up, operating, and shut-down problems.

59

ATOMIC RESEARCH FOR PEACE. Refrig. Eng., 1064-65, 1114(1950)

A description of the Brookhaven reactor with special reference to the cooling system and the many air-conditioning and refrigeration applications in the various Brookhaven laboratories.

60

AUTOMATIC CONTROL REDUCES ATOMIC-ENERGY PLANT HAZARDS. Instruments 24, 200-2(1951) Feb.

Brief descriptions of automatic temperature, humidity, static-pressure and air-velocity controls used to minimize the hazards in atomic energy plants.

61

BEPO: BRITISH EXPERIMENTAL PILE. Nucleonics 8, 36-7(1951) June.

Construction details for the larger of the two Harwell piles.

62

THE BROOKHAVEN NUCLEAR REACTOR. L. B. Borst. Phys. Today 4, 6-11(1951) (AECU-1089)

A brief description of the air-cooled, graphite-moderated nuclear reactor at Brookhaven National Laboratory with its laboratory facilities, planned research programs, and accessibility for unclassified research.

63

CRITICALITY OF THE WATER BOILER AND EFFECTIVE NUMBER OF DELAYED NEUTRONS. F. de Hoffmann. Los Alamos Scientific Laboratory. Dec. 8, 1944. Declassified Jan. 30, 1951. 27p. (AECD-3051; LADC-816) $0.15

Calibration of the water boiler made in such a way as to refer eventually to the multiplication of the primary-neutron source.

64

DEPENDENCE OF REACTIVITY OF THE WATER BOILER ON THE MASS OF 25 IN THE SPHERE. J. Hinton. Los Alamos Scientific Laboratory. Dec. 27, 1945. Declassified Jan. 25, 1951. 4p. (AECD-2956; LADC-818) $0.05

A semitheoretical determination of the percentage change in reactivity of the water boiler per gram of $U^{235}$ removed from the sphere.

65

DIMENSIONS OF THE CHÂTILLON PILE. L. Kowarski. J. phys. radium. 12, 751-5(1951).

The components of the heavy water pile at Châtillon are described, dimensions are given, and starting, operation, criticality conditions, and power level are discussed.

66

DISTRIBUTION AND POWER MEASUREMENTS IN THE WATER BOILER. L. D. P. King and R. E. Schreiber. Los Alamos Scientific Laboratory. Oct. 19, 1944. Declassified Jan. 25, 1951. 12p. (AECD-3054; LADC-820) $0.10

Part 1 describes the neutron-distribution measurements made with $U^{235}$ and $U^{238}$ fission detectors and with manganese foils. Part 2 compares the foil-distribution measurements with the theoretical predictions. The radius of an equivalent untamped sphere is determined,

and the neutron age for the boiler is calculated. Part 3 deals with detector-efficiency measurements and determinations of the power from the boiler.

67

ENGINEERING ASPECTS OF NUCLEAR REACTORS. L. A. Ohlinger. Nucleonics 5, 38-49(1949) Dec.; 6, 10-17, 25(Jan.); 54-63(Feb.); 46-57(Mar.), (1951).

Discusses basic components of the pile; factors influencing size and shape of different types of pile; nuclear fuel; structure and composition of radiation shields; construction details; application of pile heat to gas turbines, ramjets and rockets in relation to the whole system.

68

AN ENRICHED HOMOGENEOUS NUCLEAR REACTOR. Rev. Sci. Instruments 22, 489-99(1951). (AECD-3059; LADC-887)

The construction, operation, and performance of the low power and high power versions of the Los Alamos reactor known as the "Water Boiler."

69

EXPERIMENTAL PRODUCTION OF A DIVERGENT CHAIN REACTION, by E. Fermi. [Chicago Univ.] Declassified Nov. 7, 1951. 48p. (AECD-3269; CP-413; A-497)

Details to construction and operation of the first chain-reacting pile constructed in the West Stands Laboratory, University of Chicago, in 1942. 18 figures.

70

THE FIRST PILE. C. Allardice and E. R. Trapnell. Technical Information Service, AEC. Nov. 17, 1949. 13p. (TID-292) $0.10

Story of the first self-sustaining nuclear chain reaction; two drawings of the first pile are appended.

71

GAS RECOMBINATION SYSTEM OF THE LOS ALAMOS HOMOGENEOUS REACTOR, M. E. Bunker, R. P. Hammond, L. D. P. King, J. A. Leary, and W. R. Wykoff. Los Alamos Scientific Laboratory. Mar. 6, 1952. 27p. (LA-1337)

Description of the equipment and initial tests of a recombination system installed on the reactor.

72

GLEEP, DESIGN, CONSTRUCTION, AND USE. F. C. W. Colmer and D. J. Littler. Nucleonics 8, 3-11(1951) Jan.

A detailed report on the graphite low-energy experimental pile at Harwell.

73

HIGH-POWER WATER BOILER. F. L. Bentzen, R. E. Carter, J. Hinton, L. D. P. King, J. G. Nevenzel, R. E. Schreiber, J. W. Starner, and P. H. Watkins. Los Alamos Scientific Laboratory. Sept. 19, 1945. Declassified Feb. 27, 1951. 82p. (AECD-3065; LADC-822) $0.25

A detailed description of the design and construction of the 5.5 kw water boiler at Los Alamos is given. The operation and performance of the boiler are described. 34 figures.

74

HOW TO LOAD A REACTOR. Nucleonics 10, 24-5(1952) Feb.

A brief description of the reactor at Oak Ridge National Laboratory accompanied by pictures showing how the U slugs are loaded into it.

75

INSTRUMENTATION FOR AN ATOMIC POWER PLANT. D. Cochran and C. A. Hansen, Jr. Mech. Eng. 71, 808-10 (1949); Nucleonics 5, 4-11(1949) Aug. (AECD-2656)

Discussion of some of the problems involved in the application of instruments in an atomic power plant.

76

THE LOS ALAMOS HOMOGENEOUS REACTOR, SUPO MODEL, L. D. P. King. Los Alamos Scientific Laboratory. Issued Feb. 7, 1952. 17p. (LA-1301)

Extensive modifications on the Los Alamos Hypo model "water boiler" have resulted in a new model, Supo. The new reactor is described and illustrated.

77

MEASUREMENTS OF THE ORSORT URANIUM-GRAPHITE EXPONENTIAL PILE; OAK RIDGE SCHOOL OF REACTOR TECHNOLOGY. E. C. Campbell, L. D. Wyly, and E. I. Howell. Oak Ridge National Laboratory. Oct. 30, 1950. 28p. (AECD-3169; ORNL-860) $0.15

The Oak Ridge School of Reactor Technology (ORSORT) pile is described in some detail. Results are presented of measurements made on the neutron flux distribution and the Lapacian of the pile.

78

MECHANICAL FEATURES OF THE BROOKHAVEN SHIELDING FACILITY. A. C. Rand, Jr. Brookhaven National Laboratory. Dec. 1, 1951. 24p. (BNL-139)

The mechanical design of the shielding facility at Brookhaven National Laboratory reactor is reported. The facility is broken up into several major components and the design, special problems, and testing of each are described. A schematic diagram and photographs are included.

79

THE MOST RECENT AND ONE OF THE SMALLEST IN THE WORLD, ZOE, FRENCH ATOMIC PILE, IS THE FIRST ONE OF CONTINENTAL EUROPE. M. E. Nahmias. Science et Vie, 113-17(1949), Feb.

Review of research work on the atomic piles in Italy, Germany and France; description and operation of the first French pile.

80

NORWAY'S ATOMIC PILE. G. Randers and N. Hidle. Intern. Chem. Eng. and Process Inds. 33, 123-6 (1952) Mar.

Design and construction of Norway's nuclear reactor, known as the JEEP.

81

NOW A LOW-COST ATOMIC FURNACE. Chem. Eng. 58, 228, 230-1(1951) Dec.

Cost and design features of a practical low-power, multi-purpose reactor designed by North American Aviation, Inc., and particularly suited for use in industrial and institutional research, and for training of scientists and engineers in reactor operation.

82

THE NRX PILE AT CHALK RIVER. W. B. Lewis. Phys. Today 4, 12-15(1951) Nov.

The neutron flux, structure, and control system of the NRX pile are discussed. Isotope production in the pile, facilities provided for irradiation of samples, and several research projects utilizing the high flux of thermal neutrons are described.

83

NUCLEAR REACTOR CATALOG. H. S. Isbin. Nucleonics 10, 10-16(1952) Mar.

Concise tabulation of declassified details of reactors already in operation and those in advanced stages of design and construction.

84

NUCLEAR REACTORS. Chem. Eng. 58, 113-16(1951) Jan.

Released information on design, construction, and operation of specified low-power reactors used for research.

85
PROGRAM ADMINISTRATION AND INSTALLATION DESIGN OF THE NUCLEAR REACTOR PROJECT AT NORTH CAROLINA STATE COLLEGE. C. K. Beck, A. C. Menius, G. N. Webb, A. W. Waltner, P. B. Leonard, E. H. Stinson, and J. D. Paulson. North Carolina State College. July 5, 1950. Decl. Sept. 6, 1951. 79p. (ORO-33) $0.30

A brief statement of the reactor project objectives and administrative procedure is made in this report. The main body of the report concerns the general design and arrangement of the proposed "water-boiler" reactor.

86
WATER BOILER. C. P. Baker, H. K. Daghlian, G. Friedlander, M. G. Holloway, D. W. Kerst, and R. E. Schreiber. Los Alamos Scientific Laboratory. Sept. 4, 1944. Declassified Feb. 21, 1951. 45p. (AECD-3063; LADC-819) $0.15

The structural features of the uranyl sulfate water boiler (LOPO) in use at Los Alamos are given in detail with a full account of the safety features.

## REACTOR CONSTRUCTION MATERIALS

87
ATOMIC POWER FOR INDUSTRY. H. Etherington. Machine Design 20, No. 7, 91-7(1948)

A discussion of requirements to be met by materials of construction.

88
BARYTES AGGREGATES MAKE HEAVY CONCRETE FOR SHIELDING. E. G. Tirpak. Civil Eng. 21, 453-6(1951) Aug. (AECD-3134; ORNL-667)

Shielding properties, recommended specifications, and cost of production are given.

89
THE BEHAVIOR OF GRAPHITE UNDER ALTERNATING STRESS. L. Green. North American Aviation, Inc. May 4, 1951. 18p. (NAA-SR-115)

The fatigue properties of grade AUF graphite were investigated at ambient and elevated temperatures.

90
CONCRETES FOR PILE SHIELDING. A. E. Pavlish and J. C. Wynd. Battelle Memorial Inst. Aug. 1948. Declassified Nov. 9, 1950. 28p. (AECD-3007; BMI-T-4) $0.15

Investigation of cements having a wide range of water contents.

91
EFFECT OF NUCLEAR REACTOR RADIATION ON METALS. D. S. Billington and S. Siegel. Oak Ridge National Lab. Declassified Mar. 22, 1950. 30p. (AECD-2810; WAPD-1; CF-29-7-241)

Experimental evidence for changes in properties of metals produced by exposure to nuclear reactor radiation.

92
THE EFFECT OF RADIATION ON THE PHYSICAL PROPERTIES OF PLASTICS. J. G. Burr and W. M. Garrison. Argonne National Laboratory. Dec. 6, 1943. Declassified June 25, 1948. 17p. (AECD-2078) $0.10

Changes in tensile strength and electrical resistivity as a result of beta and gamma irradiation are presented for 25 different plastics and synthetic rubbers.

93
EFFECTS OF RADIATION ON MATERIALS. A. O. Allen. Clinton Laboratories. Declassified May 20, 1947. 17p. (MDDC-962) $0.10

Effects of radiation on different types of chemical bonds, simple gases, organic solids, water and aqueous solutions, metallic corrosion, and in solids.

94
HEAT TESTING OF HIGH-DENSITY CONCRETE. C. R. Binner, C. B. Wilkie, and P. Miller. H. K. Ferguson Company, Inc. June 1, 1949. 2p. (AECD-3001)

Results of tests to determine the effect of heat on the compressive strength and moisture content of the high-density concrete used in shielding.

95
THE MODULUS OF RIGIDITY OF AUF AND SA-25 GRAPHITE FROM ROOM TEMPERATURE TO 2000°C, F. E. Faris and C. A. Smith. North American Aviation, Inc. Mar. 5, 1951. 23p. (NAA-SR-108).

96
ON THE SHIELDING QUALITIES OF DIFFERENT CONCRETE MIXTURES. P. C. Gugelot and M. G. White. J. App. Phys. 21, 369-379(1950) May

Absorption curves for neutrons and $\gamma$-radiation produced by 16-Mev protons on beryllium were measured in absorber blocks of various concrete mixtures to obtain information on their shielding properties.

97
PENETRATING-RADIATION METHODS (in Nondestructive Testing). R. C. McMaster and S. A. Wenk. Materials & Methods 33, 83-7(1951) Feb.

The advantages and limitations of penetrating radiation methods for nondestructive testing of engineering materials are discussed.

98
PHOSPHATE GLASS. A. Silverman, J. J. Rothermel, and K. H. Sun. Aug. 8, 1950. (U. S. Patent 2,518,194)

Describes the composition and properties of a phosphate glass to be used for shielding against x- and gamma-radiation.

99
PHYSICAL PROPERTIES OF IRRADIATED PLASTICS. O. Sisman and C. D. Bopp. Oak Ridge National Laboratory. June 29, 1951. 226p. (ORNL-928) $0.65

Detailed results of tests conducted on thirty-three plastic materials to determine changes in the physical properties when subjected to pile radiation.

100
THE POWDER METALLURGY OF BERYLLIUM. H. H. Hausner and N. P. Pinto. Trans. Am. Soc. Metals 43, 1052-71(1951) (AECD-2869)

Data on the powder metallurgy of beryllium; evaporation during sintering in high vacuum; further data on some properties of the material in various stages, such as electrical resistivity, hardness, and other physical properties.

101
RESISTANCE OF MATERIALS TO ATTACK BY LIQUID METALS. L. R. Kelman, W. D. Wilkinson, and F. L. Yaggee. Argonne National Laboratory. July 1950. 139p. (ANL-4417)

Tabular data and descriptive material concerning the resistance of materials to attack by Na and Na-K alloys, Li, Hg, Pb, Bi, alloys of Pb and Bi, Mg, Cd, Tl, In, Ga, Al, Sn, Zn, and Sb.

102
SOME MECHANICAL PROPERTIES OF GRAPHITE AT ELEVATED TEMPERATURES. C. Malmstrom, R. Keen, and L. Green. J. Applied Phys. 22, 593-600(1951) (NAA-SR-79)

The short-time tensile breaking strength of various grades of graphite was measured as a function of temperature from room temperature to the sublimation point.

103
A SURVEY OF CERAMICS FOR NUCLEAR REACTORS. R. F. Geller. Nucleonics 7, 3-17(1950) Oct.

The physical properties of twenty-four ceramic materials are tabulated and discussed, with special emphasis on properties of interest in nuclear engineering.

104
TEST OF DENSE CONCRETE WITH IRON PUNCHINGS FOR CAVE CONSTRUCTION. D. F. Uecker, K. R. Ferguson, D. G. Seay, and C. B. Webster. Argonne National Laboratory. July 11, 1949. Declassified Nov. 24, 1950. 8p. (AECD-3013; ANL-4319)

Progress made on the development of dense concrete for $\gamma$-ray shielding, using steel punchings as aggregate.

105
WANTED: BETTER MATERIALS FOR NUCLEAR REACTORS. G. E. Evans. Iron Age 169, 93-7(1952) Mar. 13.

A brief review of the information contained in the papers presented at the Oak Ridge Summer Symposium on metallurgy on the properties required in reactor construction materials and reactor coolants.

106
WATER PROBLEMS IN THE INDUSTRIAL APPLICATION OF THE UTILIZATION OF ATOMIC ENERGY. I. Perlman. Univ. of California. Declassified Oct. 10, 1946. 8p. (MDDC-403)

A discussion of problems arising from the use of water as a pile coolant; consideration of all elements of pile structure and auxiliary equipment.

107
ZIRCONIUM. S. M. Shelton. Sci. Am. 184, No. 6, 18-21(1951)

A review of the history, physical properties, and industrial development; applicability to nuclear reactors and jet engines is stressed.

## POWER FROM NUCLEAR REACTORS

108
ATOMIC CENTRAL HEATING SYSTEM AT HARWELL. Engineer 192, 689(1951)

Outline and diagram of the first atomic central heating plant inaugurated at AERE, Harwell, where a building containing eighty offices draws heat directly from BEPO.

109
ECONOMIC ASPECTS OF ATOMIC POWER. S. H. Schurr and J. Marschak. Princeton, Princeton Univ. Press, 1950. 289p.

A comprehensive exploratory study of the economic feasibility of atomic power undertaken for the Cowles Commission for Research in Economics.

110
THE ECONOMICS OF ATOMIC POWER. S. H. Schurr. Sci. American 184, 32-8(1951) Jan.

Discusses the potential usefulness of nuclear fuels in various industries and many parts of the world.

111
ECONOMICS OF STEAM TEMPERATURE SELECTION IN NUCLEAR POWER PLANTS. R. D. Elliott. Nucleonics 10, 57-61(1952) Feb. (NAA-SR-145)

An analysis in terms of cost of optimum steam temperatures for use in electric power stations.

112
NUCLEAR ENERGY FOR POWER PRODUCTION. W. F. Davidson. Atomics (London) 1, 320-27(1950)

In this paper, read before the Fourth World Power Conference, the general engineering problems needing solution before nuclear power can be practicable are discussed. Materials, heat transfer, neutron economy, control, and shielding are briefly considered.

113
NUCLEAR FISSION AS SOURCE OF POWER. J. R. Menke. Electrometrica 15, 314-34(1947): Bull. Atomic Scientists 4, 115-21(1948). (MDDC-1104)

An estimate of the cost of producing electric energy from nuclear fission processes and comparison with coal-steam power costs; brief description of a pile; availability of resources of fissile materials.

114
NUCLEAR FUEL FOR POWER PRODUCTION. J. F. Flagg and M. J. Gross. Knolls Atomic Power Laboratory. June 26, 1951. 13p. (AECU-1631)

The basic concepts involved in the use of nuclear fuel for power production are discussed in a general non-technical way.

115
POWER FROM THE ATOM—AN APPRAISAL. C. G. Suits. Nucleonics 8, 3-8(1951) Feb.

A comparison of costs of power from atomic energy and from present-day steam plants.

116
PROGRESS REPORT ON NUCLEAR POWER. K. H. Kingdon. Nucleonics 10, 18-23(1952) Apr.

The present status of nuclear power and the possibilities for the future are discussed.

117
PROSPECTS IN INDUSTRIAL APPLICATION OF ATOMIC ENERGY. P. Sporn. Bull. Atomic Scientists 6, 306-6 (1950)

Discusses problems of reactor development; reactor development program; industrial effects of atomic power; atomic power and the coal industry.

118
REACTOR PROGRAM OF THE ATOMIC ENERGY COMMISSION. L. R. Hafstad. Bull. Atomic Sci. 7, 104-14 (1951)

Outlines the technical and economic factors which will determine the feasibility of using atomic energy as a source of power, and gives special attention to the potentialities of the envisioned multi-purpose reactor.

119
UTILIZATION OF WASTE HEAT FROM THE BRITISH EXPERIMENTAL PILE. J. Walker and H. J. Grout. Nucleonics 10, 58-60(1952) March.

Installation of a heat exchanger so designed that it does not affect the operation of BEPO adversely has made it possible to use part of the 6,000 kw removed by the pile cooling system for heating laboratory buildings.

120
WHAT ABOUT THE ATOMIC POWER PLANT? A. W. Kramer. Power Eng. 55, 70-2, 132-4(1951) Dec.

The relation of the military reactors to the development of stationary power plants is discussed. The economic and thermodynamic aspects of nuclear-power-plant development, including operating factors involved in both high- and low-temperature plants are considered. No mathematical or experimental results are given.

## HEAT TRANSFER

121
ENGINEERING ASPECTS OF LIQUID METALS FOR HEAT TRANSFER. T. Trocki. Nucleonics 10, 28-32(1952) Jan.

Liquid metals hold considerable promise as reactor coolants and heat-transfer fluids for systems operating above 600°F.

122
FINAL REPORT ON STUDIES IN BOILING HEAT TRANSFER. V. N. Tramontini, M. L. Greenfield, G. C. Wong,

R. P. Lipkis, H. I. Leon, R. K. Breeze, G. S. Arbuthnot, W. L. Martin, P. Wiener, A. Auerbach, R. E. George, J. R. Hall, F. E. Romie, B. R. Mead, A. G. Guilbert, G. H. Zizicas, B. Bussell, H. Buchberg, R. Bromberg, and L. M. K. Boelter. Mar. 1951. 516p. (COO-24)

Heat-transfer phenomena, pressure loss, and density variations associated with a heat-removal system using water as the heat-transfer medium, with and without surface boiling, were investigated with respect to conversion to useful work of energy release in a nuclear reactor.

123

HEAT TRANSFER. G. T. Skaperdas. Ind. Eng. Chem. 44, 75-84(1952) Jan.

Extension of heat transfer literature into the recently developing fields of turbulent flow theory, liquid metals, surface boiling phenomena, and compressible flow continued during 1951. 466 references.

124

HEAT TRANSFER; A BIBLIOGRAPHY OF UNCLASSIFIED REPORT LITERATURE. A. T. Morphew, comp. Technical Information Service, AEC. Mar. 18, 1952. (TID-3022) $0.25

A bibliography of 320 annotated references to unclassified research on heat transfer.

125

HEAT TRANSFER LECTURES, VOLUME I. D. Cowen. Fairchild Engine and Airplane Corp., NEPA Division. Dec. 1948. 275p. (NEPA-804)

Contains the first fifteen of a series of lectures given at the NEPA Heat Transfer Symposium, Oak Ridge, Dec. 8-13, 1947.

126

HEAT TRANSFER LECTURES, VOLUME II. D. Cowen. Fairchild Engine and Airplane Corp., NEPA Division. June 1, 1949. 345p. (NEPA-979)

Completes the series of papers on the subject at the NEPA Heat Transfer Symposium, Oak Ridge, Tennessee. Dec. 8-13, 1947.

127

LIQUID METALS HANDBOOK: A GUIDE TO THE USE OF LIQUID METALS AS HEAT-TRANSFER MEDIA. Revision. R. N. Lyon, editor-in-chief. Washington, U. S. Government Printing Office, 1952. (in print, expected to be available in December 1952)

128

NATURAL CONVECTION COOLING OF LIQUID HOMOGENEOUS REACTORS. H. Schwartz. North American Aviation, Inc. Dec. 20, 1949. 24p. (AECU-706; NAA-SR-40)

Presents a graphical method for the design of natural convection cooling systems for liquid homogeneous reactors; a specific application is considered.

129

AN UP-TO-DATE REVIEW OF THE PRINCIPLES OF HEAT TRANSFER, WITH PARTICULAR APPLICATION TO NUCLEAR POWER. C. F. Bonilla. Gibbs and Cox, Inc. 1949. 35p. (M-4476)

Covers steady-state conduction; heat transfer to fluid extended surface; heat transfer by radiation; unsteady-state heat transfer; pressure drop considerations; 48 references.

## CHEMISTRY

130

AMERICAN CHEMICAL SOCIETY SYMPOSIUM ON FLUORINE CHEMISTRY. SEPTEMBER 1946. Ind. Eng. Chem. 39, 236-434(1947).

A comprehensive study, including industrial handling and storage.

131

ANALYTICAL CHEMISTRY OF THE MANHATTAN PROJECT. C. J. Rodden, editor-in-chief. New York, McGraw-Hill Book Co., 1950. 748p. (National Nuclear Energy Series, Div. VIII, Vol. 1)

Describes the analytical methods developed to meet the precise analytical requirements of the atomic energy program.

132

THE CHEMISTRY OF URANIUM. PART I. THE ELEMENT, ITS BINARY AND RELATED COMPOUNDS. J. J. Katz and E. Rabinowitch. New York, McGraw-Hill Book Co., 1951. 609p. (National Nuclear Energy Series, Div. VIII, Vol. 5)

133

METHODS OF FLUORINE AND FLUORIDE ANALYSIS. I. F. E. McKenna. Nucleonics 8, 24-33(1951) June.

A comprehensive, annotated bibliography; covers the period 1816-1950.

134

NUCLEAR CHEMISTRY. W. J. Blaedel. Fairchild Engine and Airplane Corporation. NEPA Division. May 9, 1949. 163p. (NEPA-1010)

A series of lectures on all phases of nuclear chemistry, including chemical problems of piles and applications of nuclear techniques to chemical problems.

135

PHYSICAL PROPERTIES AND ANALYSIS OF HEAVY WATER. I. Kirshenbaum, edited by H. C. Urey and G. M. Murphy. New York, McGraw-Hill Book Co., 1951. 438p. (National Nuclear Energy Series, Div. III, Vol. 4A.)

136

RADIOCHEMICAL STUDIES. THE FISSION PRODUCTS. C. D. Coryell and N. Sugarman, eds. New York, McGraw-Hill Book Co., 1951. 3v., 2086p. (National Nuclear Energy Series, Div. IV, Vol. 9)

A collection of 336 research papers from the research program on the radiochemistry of fission products carried out on the Plutonium Project from May 1942 to June 1946.

137

THE TRANSURANIUM ELEMENTS. G. T. Seaborg, J. J. Katz, and W. M. Manning, eds. New York, McGraw-Hill Book Co., 1949). 2v., 1778p. (National Nuclear Energy Series, Div. IV, Vol. 14B)

A collection of over 150 original papers with brief historical surveys.

## SEPARATION PROCESSES

138

ANALOGIES BETWEEN GASEOUS DIFFUSION AND FRACTIONAL DISTILLATION. J. Shacter and G. A. Garrett. Carbide and Carbon Chemicals Corp., K-25 Plant. June 5, 1948. 22p. (AECD-1940; K-197(Rev.))

It is shown that the mathematical treatment of a gaseous diffusion cascade with identical stages is equivalent to the treatment of a fractional distillation column; the stage separation factor is analogous to the relative volatility in fractional distillation.

139

CHEMICAL PROBLEMS IN STABLE ISOTOPE SEPARATION. A. J. Miller and B. S. Weaver. Tennessee Eastman Corp. May 1947. 8p. (MDDC-1087; AJM-66-1)

A brief discussion of problems encountered in the electromagnetic separation of naturally occurring isotopes other than uranium.

140

DIFFUSION SEPARATION METHODS. M. Benedict. In Encyclopedia of Chemical Technology. New York, The Interscience Encyclopedia, Inc., 1950. (Vol. 5, p.76-134)

Description, principles, and comparison of methods; design of apparatus.

141
ENGINEERING DEVELOPMENTS IN THE GASEOUS DIFFUSION PROCESS. M. Benedict and C. Williams, eds. New York, McGraw-Hill Book Co., 1949. 126p. (National Nuclear Energy Series, Div. II, Vol. 16)

Covers special plant instruments and devices; vacuum engineering; development of heat transfer equipment; absorption of $UF_6$ and fluorine.

142
ION EXCHANGE AS A SEPARATION METHOD; I. THE SEPARATION OF FISSION-PRODUCED RADIOISOTOPES, INCLUDING INDIVIDUAL RARE EARTHS, BY COMPLEXING ELUTION FROM AMBERLITE RESIN. E. R. Tompkins, J. X. Khym, and W. E. Cohn. J. Am. Chem. Soc. 69, 2769-76(1947). (MDDC-1482)

Specific separations of the fission product radioisotopes, including the individual species, by ion exchange columns.

143
OAK RIDGE GIVES INDUSTRY A UNIT OPERATION GAS DIFFUSION. J. F. Hogerton. Chem. Met. Eng. 52, 98-101 (1945).

A discussion of the gaseous diffusion process and its application at the Oak Ridge Plant.

144
SEPARATION OF GAS MIXTURES BY MASS DIFFUSION. M. Benedict and A. Boas. Chem. Eng. Progress 47, 51-62; 111-22(1951).

Discusses equipment for separation of gas mixtures by column or stage type of mass diffusion process; theory of separation of isotopic mixtures by a cascade of mass diffusion columns; separation of isotopic mixtures by a cascade of mass diffusion stage; extraction of hydrogen from gas mixtures by mass diffusion column and mass diffusion stage.

145
THE THEORY OF ISOTOPE SEPARATION AS APPLIED TO THE LARGE-SCALE PRODUCTION OF $U^{235}$. K. C. Cohen, edited by G. M. Murphy. New York, McGraw-Hill Book Co., 1951. 165p. (National Nuclear Energy Series, Div. III, Vol. 1B)

In this volume centrifuges, electromagnetic methods, electrolysis, chemical exchange, thermal diffusion, and distillation are considered.

146
VACUUM EQUIPMENT AND TECHNIQUES. A. Guthrie and R. K. Wakerling. New York, McGraw-Hill Book Co., 1949. 264p. (National Nuclear Energy Series, Div. I, Vol. 1)

Compilation of observations made in the course of developing high-vacuum equipment suitable for use in electromagnetic separation plants.

## RADIATION DETECTION AND PROTECTION; RADIOLOGICAL HAZARDS

147
ABSORPTION OF $\gamma$-RAYS. W. S. Snyder and J. L. Powell. Oak Ridge National Laboratory. Nov. 7, 1949. Declassified Nov. 25, 1949. 16p. (AECD-2739; ORNL-421)

Compilation of a table of absorption coefficients as a function of the $\gamma$-ray energy and atomic number for Al, Fe, Cu, Ag, Sn, Ta, Pb, and U; estimates of the accuracy of the values presented and theoretical considerations on the photoelectric effect, Compton effect and pair production effect on $\gamma$-ray absorption.

148
BACKGROUND RADIATION MONITORING FOR CONTROL OF AN AIR-COOLED PILE. F. P. Cowan. Paper presented at the 1951 Institute of Radio Engineers National Convention, New York, Mar. 19-22.

Description of the procedure used at the Brookhaven monitoring stations.

149
BASIC PRINCIPLES OF RADIATION PROTECTION. E. E. Anderson. In Lectures Presented at the Inservice Training Course in Radiological Health, Feb. 5-8, 1951. Ann Arbor, University of Michigan School of Public Health, 1951. p.77-9.

External and internal radiation hazards and methods of protection against them are discussed.

150
BROOKHAVEN CONFERENCE REPORT: HIGH SPEED COUNTERS AND SHORT PULSE TECHNIQUES: AUGUST 14-15, 1947. Brookhaven National Laboratory. Aug. 14, 1947. 46p. (AECU-26; NBL-C-1) $0.25

Discussions on crystal and fast Geiger counters; multipliers and secondary emission phenomena; Cerenkov counters; coincidence techniques; broad band amplifiers.

151
CHALK RIVER CONFERENCE RECOMMENDS TOLERANCE VALUES. Nucleonics 6, 83(1950) Feb.

Various values for maximum permissible exposures and concentrations recommended at the Chalk River, Ontario, conference of the radiation protection committees of the United States, Great Britain, and Canada are given in tabular form.

152
THE CONCEPT OF A MAXIMUM PERMISSIBLE EXPOSURE. R. S. Stone. Radiology 58, 639-61(1952)

Biological effects of radiation are reviewed and a concept is presented for establishing maximum permissible exposure limits which is based on a large number of experiments and observations.

153
DECONTAMINATION AND CORROSION RESISTANCE PROPERTIES OF SELECTED LABORATORY SURFACES. C. D. Watson, T. H. Haley, and G. A. West. Oak Ridge National Laboratory. Aug. 29, 1950. Declassified Oct. 3, 1950. 27p. (AECD-2996(Rev.)) $0.15

The susceptibility of 50 different materials to contamination by fission products, their subsequent ease of decontamination with various reagent washes, and resistance to common laboratory reagents are described.

154
DESIGNING VENTILATION AND AIR-CONDITIONING FOR SAFETY IN AN ATOMIC ENERGY RESEARCH PROJECT. R. E. Holmes. Refrig. Eng. 59, 755-9, 808-10(1951) (AECU-1432)

Ventilation principles in an atomic energy project, ventilated bench hoods, ventilated dry boxes, caves, filter systems, and hood air-velocity control problems are discussed in a general and nontechnical manner. 10 figures.

155
HANDBOOK ON AIR CLEANING (Particulate Removal), S. K. Friedlander, L. Silverman, P. Drinker, and M. W. First. Washington, U. S. Government Printing Office, 1952. (AECD-3361, NYO-1572) (in print, expected to be available in December 1952)

Information on removing particulate matter from gases and criteria for judging their effectiveness.

156
HEALTH PHYSICS INSURANCE SEMINAR. K. Z. Morgan, E. Pollard, F. P. Cowan, J. B. H. Kuper, D. Balber, N. H. Woodruff, P. C. Aebersold, G. Failla, M. Eisenbud, H. Blatz, and G. W. Morgan. U. S. Atomic Energy Commission. Mar. 12, 1951. 161p. (TID-388) $0.50

Twelve papers covering all phases of radiation protection; includes background material.

157
HIGH EFFICIENCY COLLECTION OF RADIOACTIVE DUST. K. J. Caplan. Heating and Ventilating 48, 79-82 (1951) Feb.

The results of practical experience in dust collection at one atomic energy installation are presented. Data are given for applications involving medium and high grain loadings where the air-filter type of equipment would not be suitable. Other types of dust collectors are discussed.

158
THE INTEGRITY OF THE BIOLOGICAL SHIELD OF THE BROOKHAVEN REACTOR. W. C. Reinig and S. J. Harris. Brookhaven National Laboratory. May 15, 1951. 10p. (BNL-119) $0.10

Results of a major survey project using several techniques.

159
IONIZATION CHAMBERS AND COUNTERS: EXPERIMENTAL TECHNIQUES. B. Rossi and H. H. Staub. New York, McGraw-Hill Book Co., 1949. 243p. (National Nuclear Energy Series, Div. V, Vol. 2)

Part I contains a discussion of the physical principles basic to the operation of ionization chambers and counters. Part II deals with the various detectors developed by the authors and other scientists at Los Alamos.

160
LECTURE NOTES; HEALTH PHYSICS TRAINING LECTURES, 1948-1949. Oak Ridge National Laboratory. Sept. 29, 1950. 102p. (AECU-817) $0.35

A series of lecture notes, issued in conjunction with lectures given during the fall of 1948 to persons working in the field of health physics at the Oak Ridge National Laboratory.

161
MAXIMUM PERMISSIBLE AMOUNTS OF RADIOISOTOPES. Nucleonics 8, 70-5(1951) Feb.

The International Commission on Radiological Protection draws attention to the data on maximum permissible exposures.

162
NEW LABORATORY FUME HOODS CUT AIR CONDITIONING LOAD. J. F. Turner. Heating, Piping Air Conditioning 23, 113-16(1951)

Besides cutting air conditioning load these new hoods are safer to use for they permit lower face velocities and less interior turbulence.

163
NOMOGRAMS FOR THE CALCULATION OF GAMMA SHIELDING. J. L. Balderston, J. J. Taylor, and G. J. Brucker, Kellex Corporation. Nov. 15, 1948. Declassified Aug. 16, 1950. 33p. (AECD-2934; KLX-24)

Nomograms for calculation of shielding required for gamma-ray sources at the geometries most commonly encountered.

164
QUANTITATIVE LIMITS OF PERMISSIBLE EXPOSURE OF PERSONNEL (EXTERNAL AND INTERNAL). K. Z. Morgan. In Lectures Presented at the Inservice Training Course in Radiological Health, Feb. 5-8, 1951. Ann Arbor, University of Michigan School of Public Health, 1951. p.67-76.

Factors determining radiation damage to man, methods of calculating external exposure, establishment of maximum permissible levels, hazards of internal radiation exposure, methods by which radioisotopes enter the body, and factors that determine damage are summarized.

165
RADIOACTIVE DUST SEPARATION EQUIPMENT. I. A. L. Bralove. Nucleonics 8, 37-50(April); 60-7(May); 15-23, 33 (June) (1951).

A discussion of the practical and theoretical factors affecting separation equipment design, and a survey of methods used to remove radioactive particles from gases.

166
RADIOACTIVITY MEASUREMENT TECHNIQUES. J. H. Pannell. Massachusetts Institute of Technology. Declassified Nov. 13, 1947. 10p. (AECD-2270) $0.15

Techniques and instruments discussed include autoradiographic methods using photographic emulsions, the electroscope, scintillation methods by $\alpha$ particle impact, ionization chambers, and geiger counters.

167
SAFE HANDLING OF RADIOACTIVE ISOTOPES. Washington, National Bureau of Standards, September 1949. 30p. (Handbook 42)

General recommendations suitable for typical laboratory or small industrial operations.

168
SHIELDING FROM NUCLEAR RADIATIONS. L. A. Ohlinger. Nucleonics 5, 4-15(1949) Oct.

Basic considerations and nature of additional research needed are discussed.

169
SOME PRACTICAL CONSIDERATIONS IN RADIATION SHIELDING. G. W. Morgan. Isotopes Division, ORO, AEC. November 1948. 24p. (Isotopes Division Circular B-4) gratis.

Basic formulas for determining dosage rates for $\gamma$ radiation and shielding values for both $\beta$ and $\gamma$ radiations; derivations of formulas; data in tabular and graphic form on the shielding values of the most commonly used shielding materials.

170
SONIC PRECIPITATION OF SMOKE, FUMES AND DUST PARTICLES. M. Nord. Chem. Eng. 57, 116-19(1950) Oct.

A discussion on sonic precipitation theory, collision mechanism, historical background, use in smoke abatement, patents, and future utility including 48 references.

171
SPECIFICATIONS FOR THE CONSTRUCTION OF LOCAL EXHAUST SYSTEMS. W. B. Harris. Health and Safety Div., NYOO. June 15, 1948. 11p. (NYO-1532) $0.10

Materials, construction, design, and methods of measurement of air velocity and flow are covered.

172
STACK GAS CLEANING. M. W. First. Am. Ind. Hyg. Assoc. Quart. 11, 206-14(1950)

A review, including consideration of particle conditioning, separation by inertial forces, gas filtration, wet scrubbers, electrostatic precipitation, and gas-cleaning problems.

173
TOLERANCE CONCENTRATION OF RADIOACTIVE GASES IN AIR. G. Failla. Argonne National Laboratory. November 1942. Declassified Oct. 28, 1948. 11p. (AECD-2362; CH-1347; A-1897) $0.10

General discussion of the production of lung cancer by radiation including x-rays and those from radioactive gases; theoretical development of a tolerance rate for the inhalation of radioactive gases.

174
VENTILATION REQUIREMENTS FOR POWER REACTOR COMPARTMENTS. W. O. Passarelli, Jr. Nucleonics 10, 46-9(1952) June (AECD-3228)

Deals with the problem of determining the ventilation requirements so that operating personnel will be protected from breathing more than a tolerable amount of radioactively contaminated air.

## RADIOACTIVE WASTE AND CHEMICAL PROCESSING

175
AMERICAN CHEMICAL SOCIETY SYMPOSIUM ON RADIOACTIVE WASTES. Ind. Eng. Chem. 43, 1499-1544(1951).
Symposium on the problems and treatment on radioactive wastes; liquids and gases are considered.

176
BROOKHAVEN NATIONAL LABORATORY WASTE PROBLEMS; SECTION I; CONFERENCE ON WASTE PROCESSING; MEETING OF U. S. ATOMIC ENERGY COMMISSION WASTE PROCESSING COMMITTEE; MARCH 27-28, 1950. J. H. Hayner and B. Manowitz. Brookhaven National Laboratory. 24p. (BNL-58) $0.20
Brief reports on the geological, meteorological, and area surveys; low level monitoring; liquid waste handling and treatment; permanent disposal of radioactive waste.

177
COMPLETE RADIOACTIVE EFFLUENT CONTROL FOR A RADIOCHEMICAL LABORATORY. W. A. Rodger. Argonne National Laboratory. Sept. 1950. Declassified Mar. 6, 1951. 17p. (AECD-3078)
Type of wastes (gases, liquids, and solids) to be expected from the operation of an atomic research and development laboratory; equipment needed, operating data, costs, and systems adopted for handling these wastes.

178
A COMPLETE WASTE-DISPOSAL SYSTEM FOR A RADIOCHEMICAL LABORATORY. W. A. Rodger and P. Fineman. Nucleonics 9, 51-61(1951) Dec.
The operation of the disposal system installed at Argonne National Laboratory for the control of radioactive effluents is described.

179
DECONTAMINATION OF RADIOACTIVE WASTE AIR I. R. P. Hammond. Los Alamos Scientific Laboratory. [June 1949]. Declassified Oct. 3, 1949. 20p. (AECD-2711; LAMS-911; LADC-690) $0.10
Three-stage treatment of contaminated waste air with a baffle-plate scrubbing tower of 42 plates.

180
FINAL REPORT ON EVALUATION OF PROCESS DESIGNS FOR THE BNL WASTE CONCENTRATION PLANT. B. Manowitz, R. V. Horrigan, and H. Fried. Brookhaven National Laboratory. May 28, 1951. 18p. (BNL-112) $0.10
Five process designs of 600-gph evaporation units for concentrating dilute radioactive liquid wastes are discussed in reference to their probable engineering feasibility, maintenance problems, ease of operation, and relative costs.

181
OBSERVATIONS ON THE REMOVAL OF RADIOACTIVE MATERIALS FROM WASTE SOLUTIONS. C. P. Straub. Sewage and Ind. Wastes 23, 188-93(1951) Feb.
Separation of the wastes into their liquid and solid fractions, concentration of the radioactive fraction into a smaller volume to permit disposal either as a sludge or a slurry, incineration, and burial are discussed.

182
RADIOACTIVE WASTE DISPOSAL. J. A. Ayres. Ind. Eng. Chem. 43, 1526-31(1951) (AECD-2802)
The use of ion exchange resins for the effective removal of radioactive materials from waste solutions.

183
RADIOACTIVE WASTE DISPOSAL: A BIBLIOGRAPHY OF UNCLASSIFIED LITERATURE. Technical Information Division, ORE, AEC. 8p. (TID-375) $0.10
Highly selective bibliography of 49 references containing information on various processes and methods of waste disposal.

184
THE REMOVAL OF PLUTONIUM FROM LABORATORY WASTES. C. W. Christenson, M. B. Ettinger, G. G. Roebeck, E. R. Hermann, K. C. Kohr, and J. F. Newell. Los Alamos Scientific Laboratory. Declassified Aug. 30, 1950. 29p. (AECU-836; LADC-802) $0.10
A study undertaken to obtain information for pilot plant design in order to remove Pu from waste materials; methods investigated include coprecipitation; adsorption and activated sludge.

185
REPORT OF DESIGN FOR VOLUME PRODUCTION OF COMBUSTIBLE RADIOACTIVE WASTES BY INCINERATION. Arthur D. Little, Inc. June 30, 1950. 187p. (ALI-C-57867)
This report includes design drawings, specifications, heat and material balances, process description, operating information, and cost estimates sufficiently detailed to permit contract negotiations for the construction of a radioactive-waste incinerator. Experimental work carried out on the choice of scrubbing solution, various methods of dust collection and their efficiencies, and the settling of incinerator ash are described.

186
SENSITIVITY OF THE EVAPORATION METHOD OF LIQUID-WASTE MONITORING. F. P. Cowan and J. V. Nehemias. Nucleonics 7, 39-44(1950) Nov.
A statistical criterion for the detectability of radioactivity in waste liquids is stated and applied, by way of example, to evaluation of minimum detectable concentrations for the effluent from Brookhaven's sewage-processing plant.

187
WASTE MATERIALS IN THE UNITED STATES ATOMIC ENERGY PROGRAM. A. Wolman and A. E. Gorman. Division of Engineering, AEC. Jan. 12, 1950. 20p. (WASH-8)
A review of the problems of disposal of waste containing radioactive materials with emphasis upon the biologic concentration of radioactive materials by algae, and the removal of radioactive materials from stack gases.

## TEXTBOOKS AND REFERENCE TOOLS

188
ANNUAL REVIEW OF NUCLEAR SCIENCE, VOL. 1. Stanford, Calif., Annual Reviews, Inc., 1952. 645p.
This review, published by Annual Reviews, Inc., in cooperation with the National Research Council of the National Academy of Sciences, is the first in a series planned to cover the most important developments in the various fields of nuclear research each year. The present volume covers developments during 1950.

189
APPLIED NUCLEAR PHYSICS. 2nd. ed. E. Pollard and W. L. Davidson. New York, John Wiley and Sons, 1951. 352p.
Presentation of many phases of nuclear science, with emphasis on technical aspect; third or fourth year college level.

190
BIBLIOGRAPHY OF PARTICLE ACCELERATORS; JULY 1948 TO DECEMBER 1950. B. E. Cushman. Radiation Laboratory, Univ. of Calif. Mar. 1951. 56p. (UCRL-1238) $0.25
Included are about 380 references, a table of particle accelerators in the United States, and one of foreign accelerators.

191
BIBLIOGRAPHY OF PUBLISHED LITERATURE ON THE PREPARATION OF RADIOACTIVE NEUTRON SOURCES. F. E. Croxton. Mar. 3, 1950. 43p. (TID-295) $0.25
Annotated bibliography listing all important papers published during the period 1937 through 1949.

192
BIBLIOGRAPHY ON AEROSOLS. R. A. Strehlow. Illinois Univ. Engineering Experiment Station. Feb. 28, 1951. 218p. (SO-1003)
A bibliography of approximately 1900 references on properties, preparation and formation, coagulation, determination, collection, pollution, and meteorology culled from the literature dealing with aerosols and related systems.

193
ELECTRON AND NUCLEAR COUNTERS; THEORY AND USE. S. A. Korff. New York, D. Van Nostrand, Inc., 1946.
Extensive summation of pertinent facts regarding the theory of discharge mechanisms and practical operation of various types of counters; 3rd or 4th year college level; assumes grounding in atomic physics; valuable as a reference book.

194
ELEMENTARY PILE THEORY. H. Soodak and E. C. Campbell. New York, John Wiley and Sons, 1950. 71p.
Basic principles of pile physics; assumes knowledge of higher mathematics, but not of quantum mechanics; good introduction to technical papers; third or fourth year college level.

195
FUNDAMENTALS OF ATOMIC PHYSICS. S. Dushman. New York, McGraw-Hill Book Company, Inc., 1951. 294p.
A history of physics, and of mathematical techniques and formulas are included; problems of atomic and nuclear structures are discussed, and the quantitative relations involved are explained; recent developments concerning nuclear phenomena, atomic energy and the production of high-voltage particle accelerators are particularly noted.

196
A GENERAL ACCOUNT OF THE DEVELOPMENT OF METHODS OF USING ATOMIC ENERGY FOR MILITARY PURPOSES UNDER THE AUSPICES OF THE UNITED STATES GOVERNMENT, 1940-45. H. D. Smyth. Washington, U. S. Government Printing Office, 1945. 182p.
Scientific and technical development of the Atomic Energy Program; a requisite for any uniformed person entering the nuclear energy field.

197
A GLOSSARY OF NUCLEAR ENERGY TERMS, SECTION III, REACTOR ENGINEERING, SECTION V, CHEMICAL ENGINEERING; SECTION VI. Biophysics and Radiobiology. National Research Council Conference on Glossary of Terms in Nuclear Science and Technology. New York, The American Society of Mechanical Engineers, 1950.

198
HANDBOOK ON AEROSOLS. United States Atomic Energy Commission. (Chapters from the Summary Technical Report of Division 10, National Defense Research Committee) Washington, U. S. Government Printing Office, 1950. 147p.
Basic discussions and descriptions of theoretical and experimental importance in the field of aerosols.

199
HEAT TRANSFER. VOL. I. M. Jakob. New York, John Wiley and Sons, 1951. 758p.
Detailed study of theory and mechanism of heat transfer; presents a comprehensive discussion of the mechanism of boiling and condensation; textbook for the research worker or advanced student.

200
HEAT TRANSMISSION. W. H. McAdams. New York, McGraw-Hill Book Co., 1942. 459p.
Most complete text on theory and design information for a great variety of heat transfer problems; 4th year or graduate level.

201
AN INTERNATIONAL BIBLIOGRAPHY ON ATOMIC ENERGY. VOLUME 2. SCIENTIFIC ASPECTS. United Nations. Atomic Energy Commission Group, 1951. (Sales Agent: International Documents Service, Columbia Univ. Press, New York)
A complete review of the literature to 1949; 24,282 references.

202
INTRODUCTION TO RADIOCHEMISTRY. G. Friedlander and J. W. Kennedy. New York, John Wiley and Sons, Inc., 1950. 412p.
Graduate or 4th year college level; written for chemists; assumes good grounding in physics.

203
INTRODUCTION TO THE TRANSFER OF HEAT AND MASS. E. R. G. Eckert. New York, McGraw-Hill Book Co., 1950. 284p.
Senior or first year graduate level.

204
INTRODUCTORY NUCLEAR PHYSICS. D. Halliday. New York, John Wiley and Sons, 1950. 558p.
First year graduate or senior level; assumes grounding in atomic physics; valuable as source book in experimental methods.

205
ISOTOPIC TRACERS AND NUCLEAR RADIATIONS; WITH APPLICATION TO BIOLOGY AND MEDICINE. W. E. Siri. New York, McGraw-Hill Book Co., 1949. 653p.
Tables, graphs, and formulas, supplemented by extensive textual material and liberal references to the original literature; primarily a reference book for research workers.

206
NUCLEAR RADIATION PHYSICS. R. E. Lapp and H. L. Andrews. New York, Prentice-Hall, Inc., 1948. 487p.
Essentially nonmathematical approach; suitable for use in a survey course; third or fourth year college level.

207
POCKET ENCYCLOPEDIA OF ATOMIC ENERGY. F. Gaynor. New York, Philosophical Library, 1950. 204p.
A comprehensive collection of brief explanations and definitions of concepts in the field of nuclear physics and atomic energy.

208
RADIOACTIVITY AND NUCLEAR PHYSICS, 2ND ED. J. M. Cork. New York, D. Van Nostrand, Inc., 1950. 368p.
Third or fourth year college level, assumes grounding in elementary physical chemistry.

209
THE SCIENCE AND ENGINEERING OF NUCLEAR POWER. [VOL. I]. C. D. Goodman, ed. Cambridge, Mass., Addison-Wesley Press, 1947. 500p.
Seminars on nuclear physics; elementary pile theory; design of nuclear reactors.

210
THE SCIENCE AND ENGINEERING OF NUCLEAR POWER. VOL. II. C. D. Goodman, ed. Cambridge, Mass., Addison-Wesley Press, 1949. 317p.
Detailed information on reactor theory and design; other

seminars dealing with engineering aspects of nuclear energy.

211

SELECTED UNCLASSIFIED REFERENCES ON NUCLEAR REACTORS. TIS Staff. Technical Information Service, AEC. June 7, 1951. 11p. (TID-3006)

References selected to supply background and survey information on nuclear reactors without the details necessary for a specialized study.

212

SOURCEBOOK ON ATOMIC ENERGY. S. Glasstone. New York, D. Van Nostrand, Inc., 1950. 546p.

Presentation of important facts about past history, present status and possible future of atomic science; valuable as a reference book.

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